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Pedatadepalli, **TADEPALLIGUDEM – 534 101,** W.G. Dist, (A.P.)

Department of Electronics and Communication Engineering

Digital Communication
Question Bank
III – II Semester

Unit-I: Pulse digital modulation

S.No	Short Answer Question	Blooms Taxonomy	Program Outcome
1	Explain the simplified Block diagram of an Electronic communication system with the help of diagram.	Understand	1
2	List two examples each for analog and digital signals (in mathematical form).	Remember	2
3	Explain Shannon & Hartley's Law.	Evaluate	4
4	Construct the equation for Shannon limit on Information capacity.	Create	3
5	Explain about trade-off between bandwidth and SNR in a communication signal.	Evaluate	6
6	Define bandwidth.	Remember	5
7	Define Nyquist Sampling theorem.	Remember	8
8	Construct the mathematical expression for Minimum sampling rate (fs).	Create	2
9	Examine Aliasing Effect (or) Fold-over distortion? How it can be removed.	Analyze	1
10	List the advantages of digital communication systems	Analyze	2
11	Distinguish between natural sampling and flat top sampling with neat schematics, listing out their merits and demerits.	Analyze	8
12	Explain the principle of working a sample and hold circuit. List out its applications with neat diagrams.	Evaluate	2
13	Define the sampling theorem as applicable to voice signals on telephone lines.	Remember	4
14	Discuss the advantages and disadvantages of digital communication system.	Create	3
15	Discuss and prove sampling theorem in time domain.	Create	6
16	Definenatural sampling? Explain it with sketches.	Remember	5
17	Discuss the Hartley-Shannon law.	Create	5
18	Explain the Model of Digital Communication Systems with neat diagrams.	Understand	8
19	Explain Bandwidth-S/N Tradeoff	Understand	2
20	Summarize differential encoding signaling? Explain with an example.	Understand	1
21	Define quantization in PCM.	Remember	2

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22	Explain a simple model of nonuniformqunatizer.	Understand	4
23	Define the term quantization noise.	Remember	3
24	Compare the features of PCM and DPCM.	Analyze	6
25	List the advantage gained by the use of robust quantization.	Remember	5
26	Define an output signal-to-quantization ratio.	Remember	8
27	Mention two major sources of noise which influence the performance of a PCM system.	Knowledge	2
28	Discuss the advantages of DM over PCM.	Create	1
29	Construct the block diagram of pulse code modulation.	Apply	2
30	Define quantization noise power	Remember	1
31	Discuss about uniform quantization?	Create	2
32	Discuss about Quantization?	Create	4
33	Compare uniform and non-uniform quantization	Analy ze	3
34	Illustrate the working of DPCM transmitter and receiver with the help of diagram.	Understand	5
35	Enumerate the quantization error in delta modulation.	Application	8
36	List the comparison between PCM and DM systems.	Remember	2
37	Elaborate how to avoid slope overload distortion in DM.	Create	4
38	Illustrate the working of Adaptive DPCM with the help of diagram.	Understand	3
39	Illustrate the working of Adaptive DM with the help of diagram.	Understand	6
40	Explain the Companding.	Evaluate	5
41	Explain a)Channel Noise b) Quantization noise in DM and derive expression for them?	Evaluate	5
42	Explain the need for non-uniform quantization in digital communications.	Comprehension	8
43	Explain the Block diagram of DPCM system.	Understand	2
44	Discuss quantization error? How does it depend upon the step size? Suggest some methods to overcome the difficulties encountered depending on the modulating Amplitude swing?	Create	4
45	A TV signal with a bandwidth of 4.2MHz is transmitted using PCM with 512 quantization levels. Solve binary word code length and transmitted bit rate.	Apply	5
46	The input to the delta modulator is m(t)=5t and sampling rate is 5000 samples/sec. Determine the step size.	Evaluate	8
47	An analog signal is sampled at the Nyquist rate	Create	2

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	of20KHz and quantized into L=1024 levels. Solve the bit rate and the time-duration of one bit of the binary encoded signal.		
48	A six bit single channel PCM system gives an output of 60 kilobits per second. Determine the highest possible modulating frequency for the system.	Evaluate	4

UNIT II: Digital modulation techniques

1	Explain in detail about i. i)FSK ii. ii)PSK with waveforms and equations	Understand	5
2	Determine probability of error for a) ASK and b) PSK systems.	Create	8
3	a) Explain the demodulation of FSK using coherent detection. b) Draw the block diagram of QPSK receiver.	Create	2
4	Explain the generation of PSK signals.	Understand	4
5	a) Discuss QPSK signaling. b) Derive the bit error probability due to PSK receiver.	Create	3
6	Solve that the maximum output signal to noise ratio of a matched filter is (SNR) = 2E/N0	Create	6
7	Explain Differential phase shift keying modulation with neat block diagram. Draw the wave forms.	Create	5
8	Show that the probability of error for phase shift keying is Pe= Q(2Sav Tb/ N0)1/2 and the threshold levelis zero.	Remember	5
9	The bit stream 11011100101 is to be transmitted using DPSK. Determine the encoded sequence and the transmitted phase sequence.	Evaluate	8
10	Explain the working of DPSK modulator and demodulator.	a	
1 1	Construct the ASK and FSK waveforms for 011011.	Apply	2
12	Sketch the block diagram of ASK generation.	Remember	1
13	Examine how does pulse shaping reduce inter symbol interference?	Analyze	2
14	Show the space representation of BPSK and QPSK	Remember	1
15	Explain the Bandwidth, power and energy calculations for PSK signal.	Evaluate	2
16	Explain why PSK is always preferable over ASK in coherent detection?	Evaluate	4
17	Distinguish between Coherent and Non coherent	Analyze	3

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	detection?		
18	Explain Phase shift keying with relevant equations and waveforms.	Understand	2
19	Estimate the band width required for frequency shift keying and draw its spectrum.	Create	1
20	Explain non coherent detection of Amplitude shift keying.	Understand	2
21	Construct the constellation diagram for Quadrature phase shift keying.	Apply	1
22	Explain coherent detection of frequency shift keying .what should be the relationship between bit rate and frequency shift for a better performance?	Evaluate	2
23	Construct the FSK waveforms for a given input data “1101”.	Apply	4
24	Define the probability of error.	Remember	3
25	For the signals, the given bit rate is 10Kbps. Estimate the bandwidth for ASK and FSK signals.	Evaluate	5
2 6	Assume that 3600 bits/sec data is sent over a pass band channel by FSK signaling scheme. Estimate the transmission bandwidth.	Create	8
27	A voice signal is sampled at the rate of 5000samples/sec and each sample is encoded into 5-bits using PCM system. The binary data is transmitted into free space after modulation. Determine the bandwidth of the modulated signal, if the modulation used is a) ASK b) PSK c) FSK where f1=8MHz and f2=6MHz.	Evaluate	2
28	Binary data is transmitted over an RF band pass channel with a usable bandwidth of 10MHz at a rate of 4.8x106bits/sec using an ASK signaling method. The carrier amplitude at the receiver antenna is 1mV and noise power spectral density at the receiver input is 10-15Watt/Hz. Determine the error probability of a coherent receiver.	Evaluate	4
29	Assume that 4800 bits/sec random data are sent over band pass channel by using the following schemes: A) BPSK b) FSK Determine the Transmission bandwidth.	Evaluate	3
30	A certain telephone line bandwidth is 4 KHz. Calculate the data rate in bps that can be transmitted if we use binary	Apply	5

	signaling with raised cosine pulses and a roll off factor α=0.25.		
31	In a certain telemetry system, eight message signals having 2 kHz bandwidth each are time division multiplexed using a binary PCM Technique .the error in sampling amplitude cannot be greater than 1% of the peak amplitude. Determine the minimum transmission bandwidth required if raised cosine pulses with roll off factor α=0.2 are used the sampling rate must be at least 25% above the Nyquist rate.	Evaluate	8
3 2	A telephone line of bandwidth 4Khz required to transmit data at 6kbps using raised cosine pulses. Determine the roll of factor α		

UNIT III: DATA TRANSMISSION

1	What is a matched filter?	Remember	1
2	List two applications for eye pattern.	Analyze	2
3	What are eye pattern?	Remember	4
4	Discuss the performance of data transmission system using eye pattern technique?	Create	3
5	Discuss the need of optimum transmitting and receiving filter in baseband data transmission.	Create	6
6	Explain Signal Space Representation.	Understand	2
7	What does the width of the eye define?	Remember	1
8	Make use of the eye pattern and how the sensitivity on the system can be determined?	Apply	2
9	Explain Probability error of ASK	Understand	5
10	Explain Probability error of PSK	Understand	5
11	Explain Probability error of FSK	Understand	5
12	Explain Probability error of QPSK	Understand	5
13	Discuss maximum-likelihood decoding rule for the binary symmetric channel.	Create	5
14	Explain Pulse Shaping for Optimum Transmission.	Understand	5
15	Explain A Baseband Signal Receiver.	Understand	8
16	Explain Optimum Receiver	Evaluate	2
17	Explain Optimal of Coherent Reception	Evaluate	4

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18	Explain Signal Space Representation	Evaluate	3
19	With Neat diagram, explain Eye Diagrams	Understand	6
20	Explain Cross Talk	Understand	5
21	Why equalization is necessary in Baseband transmission? Give the block diagram of adaptive filter and explain about each element.	Remember	5
22	Explain the base band transmission of M-ary data with suitable diagrams.	Understand	8
23	What is matched filter? Derive the expression for its output SNR.	Remember	2
24	a) What is an inter symbol interference in baseband binary PAM system? Explain. b) Give the basic components of a filter in baseband data transmission and explain.	Remember	4

UNIT IV : INFORMATION THEORY

1	What is meant by distortion less transmission?	Remember	4
2	Discuss entropy and give the expression for it.	Creating	3
3	Explain the channel capacity theorem.	Understand	6
5	Let X represents the outcome of a single roll of a fair die. What is the entropy of X?	Remember	5
6	What is transition probability and when it does it will occur?	Remember	8
7	Explain the two properties of Mutual information.	Understand	2
8	State the properties of Entropy	Creating	1
9	What is discrete memory less channel and give the channel matrix expression	Understand	2
10	What is channel coding theorem and how it is different from source coding theorem?	Understand	1
11	What is entropy? Show that the entropy is maximum when all the symbols are equi probable. Assume M=2.	Understand	2
12	Define information. Show that information contained by a symbol is inversely proportional to the probability of that symbol.	Create	4
13	Consider a discrete memory less source with source alphabet S={s0, s1, s2} and source statistics {0.7,0.15,0.15}.Calculate the entropy of source.	Understand	5
14	An event has six possible outcomes with the probabilities	Remember	8

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	P1= ½, P2= ¼, P3= 1/8, P4=1/16, P5= 1/32, p6=1/32. What is the entropy of the system?		
15	A DMS X has 4 symbols x1, x2, x3, x4 with p(x1) =1/2, p(x2) =1/4, p(x3) =1/8= p(x4).Construct Shannon-fano code.Repeat for the Huffman code and compare the results.	Create	2
16	Consider the binary symmetric channel. Let P0 denote the probability of choosing binary symbol X0=0 and let P1 = 1- P0 denote the probability of choosing binary symbol X1=1. Let p denote the transition probability of the channel. Calculate the average mutual information between the channel input and channel output.	Apply	4
17	A source emits one of four possible symbols during each signaling interval. The symbols occur with the probabilities. p1=0.4, p2=0.3, p3=0.2, p4=0.1. Estimate the information gained by observing the source emitting each of these symbols.	Evaluate	3

Unit IV: Source coding

1	Show that the entropy for a discrete source is a maximum when the output symbols are equally probable.	Understand	5
2	Show that the mutual information of a channel is related to the joint entropy of the channel input and channel output.	Understand	8
3	Explain Shannon-fano coding algorithm using an example.	Creating	2
5	Explain the Huffman coding algorithm using an example.	Analyse	4
6	Explain the Conditional Entropy.	Apply	3
7	Explain the Redundancy.	Evaluate	6
8	Explain the Mutual Information	Creating	5
9	Explain the Variable length Coding with an example	Analyse	5
10	Explain the Lossy Source Coding	Creating & Analyse	8
11	a) A source emits one of 4 symbols s0, s1, s2, s3 with probabilities 1/3, 1/6,1/4,1/4 respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source. b) Derive the channel capacity theorem for discrete channels.	Evaluate	6
12	A source emits one of the four possible messages m1, m2, m3, m4 with the probabilities ½,1/4,1/8,1/8 respectively. Calculate the information content of each message and average information per message.	Evaluate	5
13	A source emits an independent sequence of symbols from	Remember	5

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	an alphabet consisting of five symbols A, B, C, D and E with symbol probabilities ¼, 1/8, 1/8, 3/16, 5/16 respectively. What is the entropy of the source?		
14	A discrete source emits one of five symbols once every millisecond. The symbol probabilities are ½, ¼, 1/8, 1/16, 1/16 respectively. What is the source entropy and information rate?	Remember	8
15	Estimate the entropy of a source that emits one of three symbols A,B, C in a statically independent sequence with probabilities ½, 1/4, and ¼ respectively.	Create	2

UNIT V:Channel coding

1	What is linear code?	Remember	4
2	Discuss code rate?	Create	3
3	Define code efficiency.	Remember	6
4	Explain hamming distance?	Understand	5
5	What is meant by systematic & non-systematic code?	Remember	8
6	Explain how syndrome is calculated in Hamming codes and cyclic codes?	Evaluate	2
7	What are the conditions to satisfy the hamming code?	Remember	4
8	Define code word & block length.	Remember	3
9	What are the advantages of cyclic codes?	Remember	6
10	What is linear code?	Remember	5
11	What is constraint length of convolution code.	Understand	5
12	List advantages of convolutional codes	Understand	8
13	Discuss the difference between convolutional code and block code.	Create	2
14	Construct the graphical representations of convolutional codes.	Create	4
15	Construct the encoding diagram for (3, 2, 1) convolutional encoder.	Apply	3
16	What is sequential decoding?	Understand	6
17	Explain about the Convolutional interleaving.	Evaluate	5
18	Compare coded and uncoded transmission techniques with respect to Probability of error.	Evaluate	5
19	What is the code length of a convolution code?	Understand	8
20	Examine the time-domain approach in convolution code.	Analyze	2
21	What is the importance of code tree?	Understand	4
22	Define the term trellis in convolution code.	Remember	3

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23	Explain Viterbi algorithm.	Create	6
24	Discuss maximum-likelihood decoding rule for the binary symmetric channel.	Create	5
25	For a (6, 3) systematic linear block code, the three parity check bits c4, c5, c6 are formed from the following equations. C4=d1+d3 C5=d1+d2+d3 C6=d1+d2 a) Construct the generator matrix G. b) Construct all possible code words.	Create	5
26	Consider the (8,4) linear block code with G= 1 0 0 0 1 1 1 1 0 1 0 0 1 1 1 1 0 0 1 0 0 0 1 1 0 0 0 1 0 1 0 1 (a) Construct all the possible code words (b) Construct all the single error patterns.	Create	8
27	For a cyclic code the generator polynomial g(x) = (x3+x2+1). a) If the received code is 1000110, determine the transmitted data. b) If the received code is 1101101, determine the transmitted data.	Evaluate	2
28	Consider a (7,4) cyclic code with generator polynomial g(x)= (x3+x2+1).Determine the code for data bits 1010,1111, and 0001	Evaluate	4
29	Show that the syndrome S is the sum of those rows of matrix HT corresponding to the error locations in the error pattern.	Understand	3
30	Consider the (8,4) linear block code with G= a) Construct all the possible code words b) Construct all the single error patterns.	Create	6
31	The polynomial x15+1 when factored gives x15+1=(x4+x3+1)(x4+x3+x2+x+1)(x4+x+1)(x2+x+1)(x+1) a) Construct a systematic (15,5)code using the generator polynomial g(x)=(x4+x3+x2+x+1)(x4+x+1)(x4+x3+1)(x+1). b) What is the minimum distance of the code? c) How many random errors per code word can be corrected?	Understand	5
32	The generator polynomial of a (7, 4) cyclic code is g(x) = 1+x+x3. Find the 16 code words of this code:	Understand	5

	a) By forming the code polynomials using v(x) = D(x)g(x), where D(x)is the message polynomial. b) Draw the encoder block diagram?		
33	For a (6,3) systematic linear block code the three parity check bits c4 , c5, c6 are formed from the following equations: c4=d1 (xor) d3 ; c5= d1 (xor) d2 (xor) d3; c6= d1 (xor) d2. a) Write down the generator matrix G b) Suppose that the received word is 010111. Decode this received word by finding the location of the error and the transmitted data bit	Understand	8
34	Construct all the possible systematic code words for (15,5) cyclic code with the following generator polynomial g(x)=x10+x8+x5+x4+x2+x+1. Construct the encoder circuit for this.	Create	2
35	What is constraint length of convolution code.	Understand	5
36	List advantages of convolutional codes	Understand	8
37	Discuss the difference between convolutional code and block code.	Create	2
38	Construct the graphical representations of convolutional codes.	Create	4
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47	Explain Viterbi algorithm.	Create	6